at the sea-level, a position favourable for air-, but not for sun-warmth. In our large towns, however, we artificially create an impenetrable barrier to solar radiation by throwing into the air the imperfectly burnt products of bituminous coal.

These products are of three kinds—soot, tar, and steam. Every ton of bituminous coal burnt in our grates gives off about 6 cwts. of volatile but condensable products. The less perfect the combustion the more tar and the less steam will be produced. If perfectly burnt without any smoke, then about 9 cwts. of steam, occupying 27,359 cubic feet at 100° C., or 20,024 cubic feet at 0° C. will be sent into the air. Now, 33,333 tons of bituminous coal are, on the average daily consumed in London in winter, giving 667,460,000 cubic feet of steam at 0° C.

This combustion of enormous quantities of bituminous coal acts in the production of town fog in three ways:—1st. By supplying the basis of all fog—condensed watery particles. 2nd. By determining the condensation of atmospheric moisture in the form of fog. 3rd. By coating the fog particles with tar, and thus making them more persistent.

All fogs have for their basis watery particles, and the greater part even of the suspended matters visible in a ray of electric light consists of these particles, for the air becomes nearly clear when it is heated somewhat above 100° C. [Experiment shown]. Everything therefore which increases the proportion of aqueous vapour in town air tends to produce fog. But aqueous vapour alone would probably never produce fog, for it condenses at once to large particles, which rapidly fall as rain. When, however, solid or liquid particles are present in the air, the minute spherules of fog are produced. This was first shown by Messrs. Coulier and Mascart, in 1875, and their results have since been confirmed by Mr. Aitkin. The speaker showed that air filtered through cotton wool, though afterwards saturated with moisture, produced no fog when its temperature was lowered; but as soon as a small quantity of the dusty air of the theatre was admitted fog was immediately formed, whilst, when a little coal smoke was introduced, a dense and more persistent fog was the result.

The fog once formed is rendered more persistent by the coating of tarry matter which it receives from the products of the imperfect combustion of smoky coal. The speaker had made numerous experiments on the retardation of evaporation by films of coal tar. He had found that the evaporation of water in a platinum dish placed in a strong draught of air was retarded in one experiment by 84 per cent. and in another by 78·6 per cent., when a thin film of coal tar was placed on the surfaces. Even by the mere blowing of coal smoke on the surface of the water for a few seconds, the evaporation was retarded by from 77·3 to 81·5 per cent. Drops of water suspended in loops of platinum wire were also found to have their evaporation retarded by coal smoke. Hence arise the so-called dry fogs which have been observed by Mr. Glaisher in balloon ascents, some examples of which are given in the following table:—

FOG IN COMPARATIVELY DRY AIR.

Place of Ascent.	Altitude.	Temperature of Air.	Degree of Humidity.
	Feet.	°F.	100 = saturation.
Wolverhampton	5,922	53·5	61
Crystal Palace	3,698	38·5	62
,, ,,	9,000	32·5	52
,, ,,	1,000	64·7	53
Wolverton	11,000	30·0	68
Woolwich	6,000	44·0	64
,,	4,400	42·0	52

Thus the smoke of our domestic fires constitutes a potent cause both for the generation and the persistency of town fogs. In London, at all events, if all manufacturing operations were absolutely to cease, the fogs would not be perceptibly less dense or irritating. Granting then this cause of town fogs, what are the remedies open to us? The speaker was of opinion that the substitution of a sufficient number of smoke-consuming grates (assuming a smoke-consuming grate to have been invented), for the 1,800,000 fire-places of London was quite hopeless, and that one remedy only could be of any appreciable service—*the importation of bituminous coal must be forbidden.* This is a case in which individual effort can do nothing; but State or municipal action would be simple and decisive.

There need be no fear that the price of smokeless fuel would rise inordinately, for the sources of this fuel are too numerous and inexhaustible to admit of either a monopoly or a serious rise in price. In addition to the enormous stores of smokeless coal in the Welsh coal-fields, every bituminous coal yields a smokeless coke, either in the retorts of gasworks or in coke ovens. On the average, 100 tons of smoky coal yields 60 tons of coke, the remaining 40 tons being driven off as combustible gas, ammoniacal liquor and tar; and as there is an almost unlimited demand for these products, it is not unlikely that they would, under the circumstances contemplated, repay the cost of coking, and it is worthy of note that coal of very inferior quality makes fairly good coke.

The only objection to the domestic use of smokeless coal and coke is the difficulty of lighting the fire, but this is obviated by the use of gas as proposed by Dr. Siemens. In ordinary grates, however, there is little difficulty in lighting and burning these smokeless fuels if the throat of the chimney be contracted so as to increase the draught. In this way nearly every grate in London could be rendered smokeless at an expenditure of a couple of shillings.

It is unnecessary to enumerate the many advantages of a smokeless atmosphere, but it may here be mentioned that London fogs not only seriously injure health but annually destroy the lives of thousands. In one week alone upwards of 1,100 lives have been thus sacrificed in London. We have doubtless still long to wait before the only remedy for London fogs will be adopted; but in the meantime, immunity from their effects, so far as the respiratory organs are concerned, may be obtained by the use of a small and very portable cotton-wool respirator which is made, in accordance with the speaker's directions, by Mr. Casella, of Holborn. [Respirator exhibited.] Armed with this little instrument, he had often passed through the densest and most irritating fogs with perfect immunity, breathing, in fact, all the time, air even purer than that of the country. Such a remedy is, however, obviously of extremely limited application.

In conclusion he said, though we may, with justice, complain of the scanty share of sunshine now received by us, let us not forget that, in our coal-fields, we are compensated by vast stores of the sunlight of past ages. How far through electricity, these stores can be evoked to supplement the present defective supply, he would be a bold man who would venture to predict. Let us not, however, continue to use this great legacy of light of the past to obscure the small one of the present.

SCIENTIFIC SERIALS

American Journal of Science, July.—Contributions to meteorology (seventeenth paper), by E. Loomis.—The phenomena of metalliferous vein-formation now in progress at Sulphur Bank, California, by J. Le Conte and W. B. Rising.—Modes of occurrence of the diamond in Brazil, by O. A. Derby.—On the influence of time on the change in the resistance of the carbon-disc of Edison's tasimeter, by T. C. Mendenhall.—Further observations on the crystallised sands of the Potsdam sandstone of Wisconsin, by A. A. Young.—On the origin of jointed structure, by G. K. Gilbert.—Break-circuit arrangements for transmitting clock-beats, by F. E. Nipher.—Cirriped crustacean from the Devonian, by J. M. Clarke.

Archives des Sciences Physiques et Naturelles, No. 7, June 15.—Contribution of astronomy to the solution of a problem of molecular physics, by M. R. Pictet.—Study of the variations of kinetic energy of the solar system, by MM. Pictet and Cellerier. Swiss Committee of Geological Unification, by M. Renevier.—On a characteristic of the Batatas, whose singularity in the family of the Convolvulaceæ has not been sufficiently remarked, by M. de Candolle.—Observation of Mr. Meehan on the variability of the English oak (*Quercus robur*), and remark by M. de Candolle.—Note on Echinida gathered in the environs of Camerino (Tuscany), by M. Canavari.

No. 7, July 15.—On the rotatory polarisation of quartz, by MM. Soret and Sarasin.—On the diffusion of bacteria, by M. Schnetzler.—Petrogenic classification or grouping of rocks according to their mode of formation, adopted for academic instruction and for the museum of Lausanne, by M. Renevier.

SOCIETIES AND ACADEMIES

VIENNA

Imperial Academy of Sciences, July 13.—O. Tumlirz, on a method for researches on the absorption of light by

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coloured solutions.—G. Gruss and K. Koegler, on the orbit of *Oenone* (215).—I. Tesar, kinematic determinations of the outline of a warped screw-plane.—A. Wassmuth, on an application of the mechanical theory of heat to the process of magnetisation.—W. Fossek, on some new derivates of isobutylaldehyde.—H. Weidel and R. Brix, contribution to the knowledge of cinchonic and pyrocinchonic acid.—A. Freund, on trimethene.—I. v. Hepperger, computation of the way of the comet 1874 III. (Coggia).

PARIS

Academy of Sciences, August 7.—M. Blanchard in the chair.—The following papers were read:—Researches on the action of ethylenic chlorhydrin on pyridic bases and on chinoline, by M. Wurtz.—Employment of photography to determine the trajectory of bodies in motion, with their velocities at each instant and their relative positions; applications to animal mechanics, by M. Marey. A body brightly illuminated is set in motion before a dark screen, and its path photographed on a very sensitive plate. Thus M. Marey obtained the path of a stone wrapped in white paper and thrown in the air; such a stone whirled by means of a string; the same while a person walked forward; a black baton with terminal white ball, with which the author traced the letters of his name, &c. To indicate velocity, the light is interrupted (say) 100 times a second, by rotation of a spoked wheel; and to determine synchronism of motion of different parts of a moving body, one of the spokes is broadened to double the length of eclipse at intervals.—On the sensibility of the cerebral lobes in mammalia, by M. Vulpian. He is unable to confirm M. Couty's observation of movements provoked by mechanical stimulation of the grey cerebral cortex. He considers the substance of the cerebral lobes to have but little sensibility.—A note from M. Vaison, at Saint Denis (island of Reunion), stated that a comet was there seen on June 16 in the Crab, with nucleus comparable to a star of the second magnitude.—Remarks concerning the problem of Kepler, by M. Radau.—Observations of solar protuberances, faculæ, and spots at the Royal Observatory of the Roman College, during the first six months of 1882, by P. Tacchini. The oscillations of the protuberances, north and south, are regular and periodic; the period of oscillation is less manifest for the spots, and for the faculæ it fails entirely. Spots and faculæ present two maxima, between ± 10° and ± 30°, as in the last half of 1881; (the faculæ reach higher latitudes than the spots). The protuberances figure in all zones, and their maxima correspond to those of the faculæ and spots. The minimum of protuberances, observed in December, extended into January; then there was an increase till March. Another minimum occurred in May.—On the longitudinal vibrations of elastic bars, &c. (continued) by MM. Sebert and Hugoniot.—On the elasticity of rarefied gases, by M. Amagat. Having repeated his experiments with modified apparatus (especially the differential barometer), he affirms that down to the lowest pressures (and he reached two-tenths of a millimetre), there does not seem to occur a sudden change in the law of compressibility of gases. They still follow the law of Mariotte with little divergence.—On the influence of a quantity of gas dissolved in a liquid on its superficial tension, by M. Wroblewski. In contradiction of M. Kundt's theory, he finds that lowering the temperature, instead of retarding the decrease of surface tension, accelerates it. The phenomena are quite independent of pressure, and depend on the state of saturation of the liquid surface (or quantity of gas dissolved in the surface layer).—Numerical relations between thermal data, by M. Tommasi. When one metal is substituted for another in a saline solution, the quantity of calorics liberated is, for each metal, always the same, whatever the nature of the acid forming part of the salt or of the halogen body united to the metal.—Researches on the telephone, by M. d'Arsonval. Various facts prove that the really active part of the wire is that lodged between the poles of the magnet; thus in the two-pole telephones, all the wire not between the poles may be considered useless resistance. He describes an instrument realising this idea; it transmits with great force and distinctness.—On the equivalent of iodides of phosphorus, by M. Troost.—Heat of formation of the principal palladium compounds, by M. Joannis.—Factitious purulent ophthalmia produced by the liquorice-liana (*Abrus precatorius*) or the jequirity of Brazil, by M. de Wecker.—Researches on chinoline and on lutidine, by M. Amé Pictet.—The vaso-dilator nerves of the ear, by MM. Dastre and Morat.—Researches on the pancreas of cyclostomes, and on the liver without excretory canal of *Petromyzon marinus*, by M. Legouis.—Direct observation of the motion of water in the vessels of plants, by M. Veigne. He describes microscopical observations on cut stems of *Tradescantia zebrina* and *Hartwegia comosa* verifying recent views of M. Boehm.—Simultaneous existence of flowers and insects on the mountains of Dauphiné, by M. Musset. Flowers and insects being never simultaneously and mutually wanting, Heckel's objection to cross-fertilisation on the score of absence or rarity of these auxiliary animals on flower-bearing summits loses all value.—M. Bigi presented a self-winding clock, depending on thermo-electric currents produced by variations of temperature.

BERLIN

Physiological Society, July 28.—Prof. Du Bois Reymond in the chair.—Dr. Saltet has, by a series of experiments in the Berlin Physiological Institute on frog's hearts that were traversed by different liquids, and placed in various baths, sought to determine the cause of their fatigue. It appeared that the carbonic acid formed by the heart-muscle in its action acts prejudicially to its nutrition and work; it diminishes the height and frequency of the pulse, so long as it is in contact with the muscle-fibres. On the other hand, fatigue of the heart does not occur, when, by strong contraction, the carbonic acid is separated from the muscle-fibres, and, mixing with the nutritive liquid, is carried away with it. For prevention of fatigue, moreover, those baths acted very favourably, into which the carbonic acid easily diffused, *e.g.* alkaline and ordinary salt-solutions; whereas, in an oil-bath which does not take up the carbonic acid, fatigue occurs very quickly, under like conditions. A heart fatigued in the oil bath, being brought into a salt solution, while the same nutritive liquid passed through, the fatigue disappeared, and the pulsations reappeared, probably because the carbonic acid could now diffuse away. Quite similar results were arrived at by Herr Joseph Denys by experiments on other involuntary muscles of the frog, whose contractions, with maximum stimulation, were indicated by the kymographion. It appeared from this investigation, also carried out under the guidance of Prof. Kronecker, that carbonic acid is the most probable cause of the diminished work, as the curves increased in height when, during rest, the muscle was traversed by liquids which could absorb the carbonic acid.—Prof. Kronecker reported finally on experiments by Dr. Wedenski, on the muscle tone in electric stimulation. The observations were made with a telephone, and showed an essential agreement between the number of the vibrations heard and the frequency of the electric stimuli. On voluntary contraction of his arm-muscles, Dr. Wedenski heard a deep humming tone, whereby, on the whole, the data of previous observers as to the pitch of the muscle-tone were confirmed.

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